

Chapter 3: The Periodic Table

- Dmitri Mendeleev (1834-1907)

He developed the first periodic table in 1870. He listed the elements in increasing order of atomic mass and noticed that columns of elements share properties.

- "family": is a vertical column of elements on the periodic table.

- The following are some specific families:

1. The Alkali metals (column IA – excluding H)

- all have one valence electron.
- all form +1 ions.
- all react quickly and easily with the halogens (VII A)
- these are the most reactive metals

2. The Alkaline Earth metals (column II A)

- all have two valence electrons.
- all form +2 ions.
- this is the second most reactive group of metals.

3. The Halogens (column VII A)

- all have 7 valence electrons.
- all form -1 ions
- most reactive nonmetals
- so reactive that atoms occur in pairs. i.e. all are diatomic: Cl_2 , F_2 , etc.
- all toxic

4. The Noble Gases (column VIII A) / Inert Gases

- all have full outer orbits of electrons
- all are unreactive i.e. will not react with other elements to form compounds.

- All other vertical columns / families are named according to the element at the top.

e.g. column III A is the Boron Family
column V A is the Nitrogen Family

- A horizontal row in the periodic table is called a period. Periods are numbered.

e.g. period #1 includes H and He

period #2 includes Li, Be, B, C ...

period #3 includes Na, Mg, Al, Si ...

- Elements to the left of the staircase are metals; elements to the right of the staircase are nonmetals.
Exception: this course classifies H as a nonmetal.
- Transition Elements / Transition Metals : Sc – Zn and below (shown on white periodic table that I gave you).
- Actinides; Th – Lr (last period on table)
 - properties are similar
 - heaviest elements on periodic table
 - most are manmade
 - known as “radioactive elements”
- Hydrogen is often called a “Family of One”. It’s the lightest and most abundant element. It is not grouped into any other families.
- See periodic table ; at STP (0°C, 101.3 kPa) Hg and Br₂ are liquids; gases are shown in grey; rest are solids.
- Elements in the modern periodic table are arranged in increasing order of atomic number.
- Atomic number = # protons in the nucleus

(NB. # protons = # electrons for a neutral atom)

- Mass number = # protons + # neutrons in the nucleus.

$$\# \text{ neutrons} = \text{mass number } (\#n + \#p) - \text{atomic number } (\#p)$$

e.g. C mass # = 12 (round to nearest whole #)

atomic # = 6

$$\# p = 6$$

$$\# n = 12 - 6 = 6$$